

Helminths of 12 Species of *Anolis* Lizards (Polychrotidae) from the Lesser Antilles, West Indies

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ABSTRACT: Twelve species of anoles (*Anolis aeneus*, *A. extremus*, *A. gingivinus*, *A. griseus*, *A. luciae*, *A. marmoratus*, *A. oculatus*, *A. richardi*, *A. roquet*, *A. sabanus*, *A. trinitatis*, and *A. watsi*) from the Lesser Antilles were examined for helminths. Twelve species of helminths were found: *Mesocoelium monas*, *Oochoristica maccoyi*, *Oswaldocruzia marechali*, *Parapharyngodon cubensis*, *Spauligodon caymanensis*, *Trichospirura teixeirai*, *Abbreviata* sp., *Ascarops* sp., *Physaloptera* sp., *Physocephalus* sp., *Porrocaecum* sp., and *Centrorhynchus* sp. Twenty-nine new host records are reported. The highest prevalence (75%) was *P. cubensis* in *A. sabanus*; greatest mean intensity (56.8) was *S. caymanensis* in *A. marmoratus*. The highest diversity of helminths was found in *Anolis gingivinus*, which harbored 9 species; the lowest diversity occurred in *A. trinitatis*, which harbored 1 species. Islands with the greatest numbers of helminth species are located in the northern Lesser Antilles.

KEY WORDS: *Anolis*, Polychrotidae, Acanthocephala, Cestoda, Nematoda, Trematoda, Lesser Antilles.

The genus *Anolis* Daudin contains some 300 species that inhabit Central America, southern U.S.A. northern South America, and the Caribbean islands (Roughgarden, 1995). About 130 species are known from the West Indies alone (Schwartz and Henderson, 1991). The isolation necessary for such diversity to evolve was provided by the splitting of ancestral stock into some 3,000 separate populations at the end of the last Ice Age (Roughgarden, 1995). The larger islands of the Greater Antilles have more species of *Anolis*; there are over 35 in Cuba, over 35 in Hispaniola, 11 in Puerto Rico, and 7 in Jamaica; small islands, as typified by the Lesser Antilles, have 1 or 2 species (Roughgarden, 1995).

Sixteen species of anoles occur on the islands of the Lesser Antilles, namely, *Anolis aeneus* Gray, 1840, *A. bimaculatus* Sparrman, 1874, *A. extremus* Garman, 1888, *A. ferreus* Cope, 1864, *A. gingivinus* Cope, 1864, *A. griseus* Garman, 1888, *A. lividus* Garman, 1888, *A. luciae* Garman, 1888, *A. marmoratus* Duméril and Bibron, 1837, *A. nubilus* Garman, 1888, *A. oculatus* Cope, 1879, *A. richardi* Duméril and Bibron, 1837, *A. roquet* Lacépède, 1788, *A. sabanus* Garman, 1887, *A. trinitatis* Reinhardt and Lütken, 1863, and *A. watsi* Boulenger, 1894. Five of these have been introduced to other regions:

A. aeneus in Trinidad and Guyana; *A. bimaculatus* in Bermuda; *A. extremus* in St. Lucia, Bermuda, and Caracas, Venezuela; *A. roquet* in Bermuda; and *A. trinitatis* in Trinidad (Schwartz and Henderson, 1991). Although anoles of the Lesser Antilles have been studied extensively (see Roughgarden, 1995), there are reports of helminths from only *A. bimaculatus*, *A. ferreus*, *A. gingivinus*, *A. lividus*, *A. marmoratus*, *A. oculatus*, *A. sabanus*, and *A. watsi* (Dobson et al., 1992; Ben Slimane et al., 1995; Goldberg and Bursey, 1996; Goldberg et al., 1996a). The purpose of this paper is to report helminths from *Anolis aeneus*, *A. extremus*, *A. gingivinus*, *A. griseus*, *A. luciae*, *A. marmoratus*, *A. oculatus*, *A. richardi*, *A. roquet*, *A. sabanus*, *A. trinitatis*, and *A. watsi* and to compare helminth infections among anoles of the Lesser Antilles.

Materials and Methods

All anoles examined in this study ($N = 261$) were museum specimens (for museum accession numbers, see Appendix 1). Anole species, collection location, sample size, and mean snout–vent length in millimeters are given in Table 1. The islands of the Lesser Antilles labeled with the species of *Anolis* we examined for helminths are shown in Figure 1. The body cavity was opened by a longitudinal incision from vent to throat, and the digestive tract was removed by cutting across the anterior esophagus and rectum. The esophagus, stomach, and small and large intestines were slit longitudinally and examined under a dissecting microscope. The gallbladder, liver, and body cavity

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Table 1. Samples of *Anolis* lizards examined from the Caribbean.

Species	Locality	N	\bar{x} snout-vent length \pm SD (mm)	Range (mm)
<i>Anolis aeneus</i>	Grenada	20	62.2 \pm 3.7	54–68
<i>Anolis extremus</i>	Barbados	5	64.0 \pm 8.0	53–70
	St. Lucia	5	61.4 \pm 3.4	57–66
<i>Anolis gingivinus</i>	Anguilla	64	50.6 \pm 6.8	39–63
	St. Barthélemy	14	58.4 \pm 4.9	43–64
<i>Anolis griseus</i>	St. Vincent	10	91.7 \pm 13.1	74–107
<i>Anolis luciae</i>	St. Lucia	34	64.5 \pm 12.3	31–82
<i>Anolis marmoratus</i>	Guadeloupe	25	60.8 \pm 4.6	48–68
<i>Anolis oculatus</i>	Dominica	11	69.1 \pm 9.7	52–80
<i>Anolis richardi</i>	Grenada	20	91.5 \pm 11.7	66–110
<i>Anolis roquet</i>	Martinique	4	58.0 \pm 7.2	51–68
<i>Anolis sabanus</i>	Saba	12	53.0 \pm 4.8	45–60
<i>Anolis trinitatis</i>	St. Vincent	17	52.4 \pm 8.8	37–68
<i>Anolis wattsi</i>	Antigua	20	41.3 \pm 3.4	36–47

were also searched for helminths. Each helminth was initially placed in a drop of glycerol on a glass slide. Nematodes were identified from these temporary mounts. Cestodes were stained with hematoxylin, mounted in balsam, and identified. Acanthocephalans were cleared in xylene, mounted in balsam, and assigned to a genus.

Results

The helminths found in the 12 anole species examined in this study consisted of 1 species of trematode, *Mesocoelium monas* (Rudolphi, 1819); 1 species of cestode, *Oochoristica maccoyi* Bursey and Goldberg, 1996; 9 species of nematodes, *Oswaldocruzia marechali* Ben Slimane, Durette-Desset, and Chabaud, 1995, *Parapharyngodon cubensis* (Baruš and Coy Otero, 1969), *Spauligodon caymanensis* Bursey and Goldberg, 1995, *Trichospirura teixeirai* (Baruš and Coy Otero, 1968), *Abbreviata* sp., *Ascarops* sp., *Physaloptera* sp., *Physocephalus* sp., and *Porrocaecum* sp., and 1 species of acanthocephalan, *Centrorhynchus* sp. The first 6 species were represented by mature individuals; only immature individuals of the latter 6 species were found. Occurrences of helminths and 29 new host records are listed in Table 2. Helminths were placed in vials of 70% ethanol and deposited in the United States National Parasite Collection [USDA], Beltsville, Maryland (Appendix 2).

Discussion

The known helminth fauna for anoles of the Lesser Antilles is presented in Table 3. Only *Anolis nubilis*, which is restricted to the tiny is-

land of Redonda (ca. 19 km NW of Montserrat), is unlisted and remains to be examined. For these anoles, known helminths consist of 2 species of trematodes, *Alloglyptus crenshawii* Byrd, 1950, and *Mesocoelium monas*; 1 species of cestode, *Oochoristica maccoyi*; 14 species of nematodes, *Abbreviata* sp., *Ascarops* sp., *Physaloptera* sp., *Physocephalus* sp., *Porrocaecum* sp., represented by larvae only, *Oswaldocruzia dorsarmata* Ben Slimane, Durette-Desset, and Chabaud, 1995, *O. jeanbarti* Ben Slimane, Durette-Desset and Chabaud, 1995, *O. marechali*, *O. mauleoni* Ben Slimane, Durette-Desset and Chabaud, 1995, *Parapharyngodon cubensis*, *Rhabdias* sp., *Spauligodon caymanensis*, *Spinicauda spinicauda* (Olfers, 1819), and *Trichospirura teixeirai*; and 1 species of acanthocephalan, *Centrorhynchus* sp., represented by cystacanths only. With the exception of *Oochoristica maccoyi*, *Oswaldocruzia dorsarmata*, *O. jeanbarti*, *O. marechali*, and *O. mauleoni*, all of these helminths have been reported from other amphibian or reptilian host species, some of which are outside the Lesser Antilles (Baker, 1987).

The life cycles of *Alloglyptus crenshawii* and *Mesocoelium monas* have not yet been investigated, but they are the only trematodes so far reported from anoles of the Lesser Antilles and could be expected to exhibit typical life cycles. *Alloglyptus crenshawii* was described by Byrd (1950) from 30 specimens found in the small intestine of 1 *Anolis carolinensis* collected in Georgia. It has been found in 3 *Anolis carolinensis* collected in Putnam County, Florida

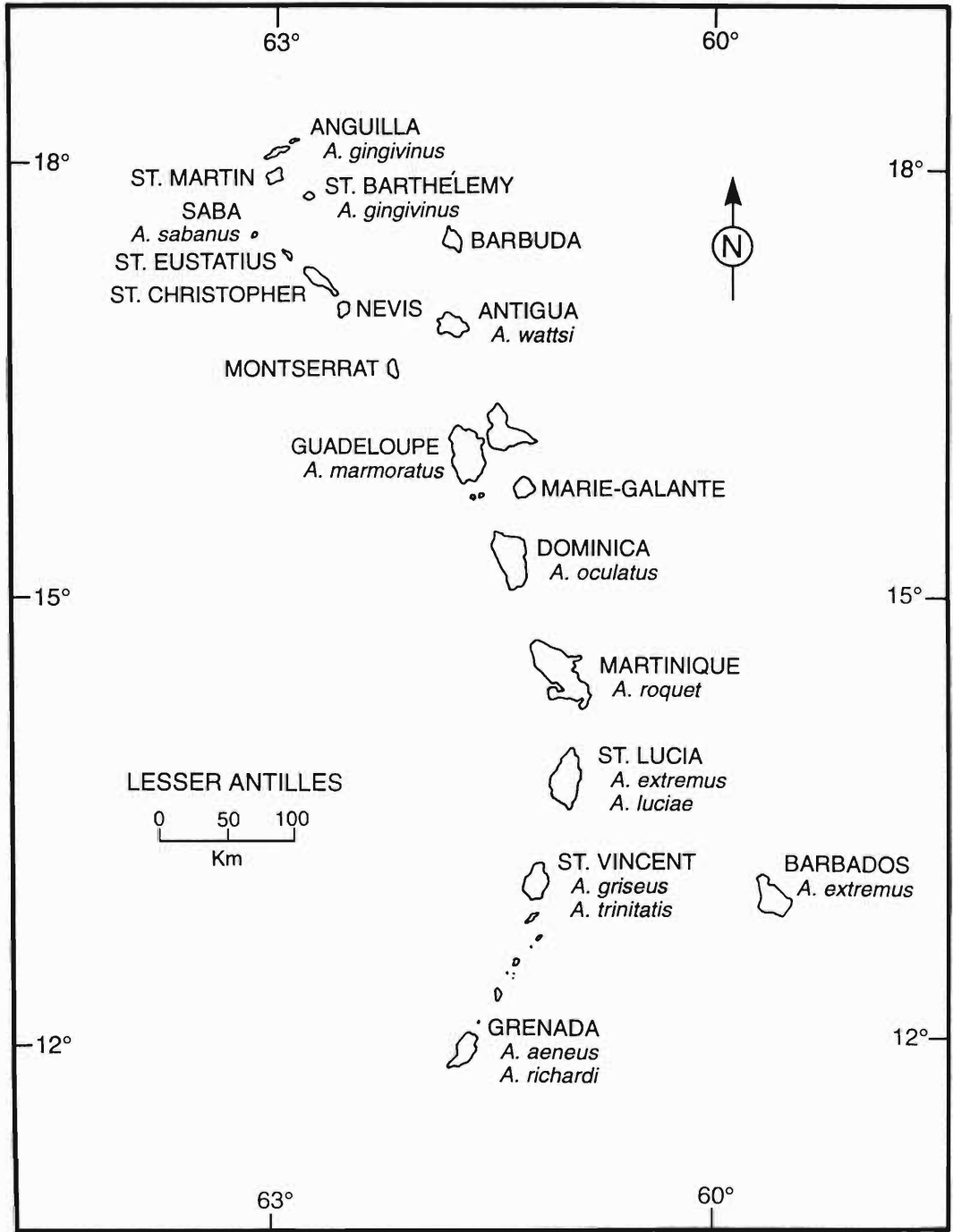


Figure 1. Islands of the Lesser Antilles with species of *Anolis* labeled next to the island from which they were collected. All other named islands are sites with published records of helminths from *Anolis* spp.

Table 2. Prevalence and mean intensity of helminths found in *Anolis* spp. examined in this study.

Species	Helminth	Prevalence	Mean intensity	Range	Site
<i>Anolis aeneus</i>	<i>Parapharyngodon cubensis</i> *	25% (5/20)	1.2	1–2	Large intestine
	<i>Physocephalus</i> sp. (larvae)*	5% (1/20)	2.0	—	Encysted stomach wall
	<i>Centrorhynchus</i> sp. (cystacanths)*	15% (3/20)	1.0	—	Coelom
<i>Anolis extremus</i>	<i>Ascarops</i> sp. (larvae)*	30% (3/10)	6.7	1–12	Encysted stomach wall
	<i>Parapharyngodon cubensis</i> *	20% (2/10)	4.0	2–6	Large intestine
	<i>Trichospirura teixeirai</i> *	20% (2/10)	5.5	3–8	Gallbladder
<i>Anolis gingivinus</i>	<i>Mesocoelium monas</i>	1% (1/78)	1.0	—	Small intestine
	<i>Oochoristica maccoyi</i>	8% (6/78)	1.5	1–3	Small intestine
	<i>Abbreviata</i> sp. (larvae)*	10% (8/78)	14.5	1–72	Encysted stomach wall
	<i>Ascarops</i> sp. (larvae)*	8% (6/78)	4.3	1–9	Encysted stomach wall
	<i>Parapharyngodon cubensis</i>	32% (25/78)	2.0	1–5	Large intestine
	<i>Physocephalus</i> sp. (larvae)*	3% (2/78)	1.5	1–2	Encysted stomach wall
	<i>Spauligodon caymanensis</i>	23% (18/78)	12.9	1–65	Large intestine
	<i>Trichospirura teixeirai</i> *	1% (1/78)	1.0	—	Gallbladder
	<i>Centrorhynchus</i> sp. (cystacanths)*	3% (2/78)	2.5	1–4	Coelom
<i>Anolis griseus</i>	<i>Ascarops</i> sp. (larvae)*	20% (2/10)	1.5	1–2	Encysted stomach wall
	<i>Parapharyngodon cubensis</i> *	60% (6/10)	8.0	2–14	Large intestine
	<i>Physaloptera</i> sp. (larvae)*	10% (1/10)	1.0	—	Stomach
<i>Anolis luciae</i>	<i>Oochoristica maccoyi</i> *	3% (1/34)	1.0	—	Small intestine
	<i>Parapharyngodon cubensis</i> *	44% (15/34)	2.3	1–7	Large intestine
	<i>Porrocaecum</i> sp. (larvae)*	9% (3/34)	14.3	5–23	Encysted coelom
<i>Anolis marmoratus</i>	<i>Oswaldocruzia marechali</i>	4% (1/25)	2.0	—	Small intestine
	<i>Parapharyngodon cubensis</i> *	40% (10/25)	3.0	1–9	Large intestine
	<i>Spauligodon caymanensis</i> *	48% (12/25)	56.8	1–417	Large intestine
<i>Anolis oculatus</i>	<i>Mesocoelium monas</i>	18% (2/11)	3.0	2–4	Small intestine
	<i>Oswaldocruzia marechali</i>	18% (2/11)	1.0	—	Small intestine
	<i>Parapharyngodon cubensis</i>	27% (3/11)	1.7	1–3	Large intestine
	<i>Physaloptera</i> sp. (larvae)	18% (2/11)	1.5	1–2	Stomach
	<i>Spauligodon caymanensis</i>	27% (3/11)	6.3	2–11	Large intestine
	<i>Trichospirura teixeirai</i> *	9% (1/11)	9.0	—	Gallbladder
<i>Anolis richardi</i>	<i>Centrorhynchus</i> sp. (cystacanths)	18% (2/11)	7.0	2–12	Coelom
	<i>Parapharyngodon cubensis</i> *	65% (13/20)	4.2	1–23	Large intestine
	<i>Physocephalus</i> sp. (larvae)*	5% (1/20)	18.0	—	Encysted stomach wall
	<i>Spauligodon caymanensis</i> *	10% (2/20)	6.0	2–10	Large intestine
<i>Anolis roquet</i>	<i>Centrorhynchus</i> sp. (cystacanths)*	10% (2/20)	5.0	1–9	Coelom
	<i>Parapharyngodon cubensis</i> *	25% (1/4)	2.0	—	Large intestine
<i>Anolis sabanus</i>	<i>Physocephalus</i> sp. (larvae)*	25% (1/4)	9.0	—	Encysted stomach wall
	<i>Mesocoelium monas</i>	8% (1/12)	1.0	—	Small intestine
	<i>Abbreviata</i> sp. (larvae)*	17% (2/12)	1.5	1–2	Encysted stomach wall
<i>Anolis trinitatis</i>	<i>Parapharyngodon cubensis</i>	75% (9/12)	1.8	1–3	Large intestine
	<i>Physocephalus</i> sp. (larvae)*	18% (3/17)	25.7	22–33	Encysted stomach wall
<i>Anolis wattsi</i>	<i>Abbreviata</i> sp. (larvae)*	15% (3/20)	1.0	—	Encysted stomach wall
	<i>Parapharyngodon cubensis</i>	70% (14/20)	1.9	1–4	Large intestine
	<i>Spauligodon caymanensis</i>	10% (2/20)	2.5	1–4	Large intestine
	<i>Trichospirura teixeirai</i>	10% (2/20)	5.5	3–8	Gallbladder

* New host record.

(Franz and Telford, 1972) and was also reported from the Georgia population by Sellers and Hertz (1982). The only other report of *Alloglyptus crenshawii* is that of Dobson et al. (1992). All of these reports involve only anoles as hosts.

Mesocoelium monas has been reported fre-

quently from the toad, *Bufo marinus*, from widely separated geographical regions such as Brazil, Colombia, Costa Rica, Hawaii, Paraguay, Puerto Rico, and Samoa (Nasir and Díaz, 1971; Goldberg and Bursey, 1992). It is also known from other amphibians and reptiles (Acholonu, 1976;

Table 3. Helminths and *Anolis* hosts of the Lesser Antilles.

Helminth	Host	Island	Reference
Trematoda			
<i>Alloglyptus crenshawii</i>	<i>A. gingivinus</i>	St. Martin	Dobson et al., 1992
	<i>A. lividus</i>	Montserrat	Dobson et al., 1992
<i>Mesocoelium monas</i>	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
	<i>A. gingivinus</i>	Anguilla	This paper
		St. Martin	Dobson et al., 1992
	<i>A. oculatus</i>	Dominica	This paper
		Dominica	Goldberg and Bursey, 1996
	<i>A. sabanus</i>	Saba	This paper
		Saba	Dobson et al., 1992
Cestoda			
<i>Oochoristica maccoyi</i>	<i>A. bimaculatus</i>	Antigua	Goldberg et al., 1996a
	<i>A. gingivinus</i>	Anguilla	This paper
		Anguilla	Bussey and Goldberg, 1996
	<i>A. trinitatis</i>	St. Vincent	This paper
Nematoda			
<i>Abbreviata</i> sp.	<i>A. bimaculatus</i>	Antigua	Goldberg et al., 1996a
	<i>A. gingivinus</i>	Anguilla	This paper
	<i>A. sabanus</i>	Saba	This paper
	<i>A. wattsi</i>	Antigua	This paper
<i>Ascarops</i> sp.	<i>A. extremus</i>	Barbados	This paper
	<i>A. gingivinus</i>	Anguilla	This paper
	<i>A. griseus</i>	St. Vincent	This paper
	<i>A. oculatus</i>	Dominica	Goldberg and Bursey, 1996
<i>Oswaldocruzia dorsarmata</i>	<i>A. marmoratus</i>	Guadeloupe	Ben Slimane et al., 1995
<i>Oswaldocruzia jeanbarti</i>	<i>A. marmoratus</i>	Guadeloupe	Ben Slimane et al., 1995
<i>Oswaldocruzia marechali</i>	<i>A. marmoratus</i>	Guadeloupe	Ben Slimane et al., 1995
	<i>A. marmoratus</i>	Guadeloupe	This paper
	<i>A. oculatus</i>	Dominica	This paper
		Dominica	Goldberg and Bursey, 1996
<i>Oswaldocruzia mauleoni</i>	<i>A. marmoratus</i>	Guadeloupe	Ben Slimane et al., 1995
<i>Parapharyngodon cubensis</i>	<i>A. aeneus</i>	Grenada	This paper
	<i>A. bimaculatus</i>	Antigua	Goldberg et al., 1996a
		Antigua	Dobson et al., 1992
		Barbuda	Goldberg et al., 1996a
		Nevis	Goldberg et al., 1996a
		St. Christopher	Goldberg et al., 1996a
		St. Eustatius	Goldberg et al., 1996a
		St. Eustatius	Dobson et al., 1992
	<i>A. extremus</i>	Barbados	This paper
	<i>A. ferreus</i>	Marie-Galante	Dobson et al., 1992
	<i>A. gingivinus</i>	Anguilla	This paper
		Anguilla	Dobson et al., 1992
		St. Martin	Dobson et al., 1992
	<i>A. griseus</i>	St. Vincent	This paper
	<i>A. lividus</i>	Montserrat	Dobson et al., 1992
	<i>A. luciae</i>	St. Lucia	This paper
	<i>A. marmoratus</i>	Guadeloupe	This paper
	<i>A. oculatus</i>	Dominica	This paper
		Dominica	Goldberg and Bursey, 1996
	<i>A. richardi</i>	Grenada	This paper
	<i>A. roquet</i>	Martinique	This paper
	<i>A. sabanus</i>	Saba	This paper
		Saba	Dobson et al., 1992
	<i>A. wattsi</i>	Antigua	This paper
		Antigua	Dobson et al., 1992
		St. Eustatius	Dobson et al., 1992
		St. Martin	Dobson et al., 1992

Table 3. Continued.

Helminth	Host	Island	Reference
<i>Physaloptera</i> sp.	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
		Barbuda	Goldberg et al., 1996a
	<i>A. griseus</i>	St. Vincent	This paper
	<i>A. lividus</i>	Montserrat	Dobson et al., 1992
	<i>A. oculatus</i>	Dominica	This paper
<i>Physocephalus</i> sp.		Dominica	Goldberg and Bursey, 1996
	<i>A. wattsi</i>	Antigua	Dobson et al., 1992
		St. Eustatius	Dobson et al., 1992
	<i>A. aeneus</i>	Grenada	This paper
	<i>A. gingivinus</i>	Anguilla	This paper
<i>Porrocaecum</i> sp.		St. Barthélemy	This paper
	<i>A. richardi</i>	Grenada	This paper
	<i>A. roquet</i>	Martinique	This paper
	<i>A. trinitatis</i>	St. Vincent	This paper
	<i>A. luciae</i>	St. Lucia	This paper
<i>Rhabdias</i> sp.	<i>A. wattsi</i>	St. Eustatius	Dobson et al., 1992
<i>Spauligodon caymanensis</i>	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
		St. Eustatius	Goldberg et al., 1996a
		St. Eustatius	Dobson et al., 1992
	<i>A. ferreus</i>	Marie-Galante	Dobson et al., 1992
	<i>A. gingivinus</i>	Anguilla	This paper
		Anguilla	Dobson et al., 1992
		St. Barthélemy	This paper
	<i>A. lividus</i>	Montserrat	Dobson et al., 1992
	<i>A. marmoratus</i>	Guadeloupe	This paper
	<i>A. oculatus</i>	Dominica	This paper
		Dominica	Goldberg and Bursey, 1996
	<i>A. richardi</i>	Grenada	This paper
	<i>A. sabanus</i>	Saba	Dobson et al., 1992
	<i>A. wattsi</i>	Antigua	This paper
		Antigua	Dobson et al., 1992
		St. Eustatius	Dobson et al., 1992
	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
	<i>A. oculatus</i>	Dominica	Goldberg and Bursey, 1996
<i>Trichospirura teixeirai</i>	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
	<i>A. extremus</i>	Barbados	This paper
	<i>A. gingivinus</i>	Anguilla	This paper
	<i>A. oculatus</i>	Dominica	This paper
	<i>A. wattsi</i>	Antigua	This paper
<i>Acanthocephala</i>			
<i>Centrorhynchus</i> sp.	<i>A. aeneus</i>	Grenada	This paper
	<i>A. bimaculatus</i>	Antigua	Dobson et al., 1992
		St. Eustatius	Dobson et al., 1992
	<i>A. gingivinus</i>	Anguilla	This paper
	<i>A. lividus</i>	Montserrat	Dobson et al., 1992
	<i>A. oculatus</i>	Dominica	This paper
		Dominica	Goldberg and Bursey, 1996
	<i>A. richardi</i>	Grenada	This paper
	<i>A. wattsi</i>	Antigua	Dobson et al., 1992
		St. Eustatius	Dobson et al., 1992

Price and Underwood, 1984; Bundy et al., 1987; Sellers and Graham, 1987; Dobson et al., 1992; Goldberg and Bursey, 1996; Goldberg et al., 1996a).

Oochoristica maccoyi was recently described from *A. gingivinus* from Anguilla (Bursey and

Goldberg, 1996). It has been found in *A. bimaculatus* from Antigua (redetermination of the specimen in Goldberg et al., 1996a). *Anolis luciae* is a new host record for *O. maccoyi*.

The nematodes separate into 2 categories. Five are heteroxenous helminths requiring an in-

intermediate host: *Abbreviata* sp., *Ascarops* sp., *Physaloptera* sp., *Physocephalus* sp., and *Porrocaecum* sp. These species were represented by encysted larvae in the species of *Anolis* studied here, but they are known to parasitize a wide variety of vertebrates as adults and are found encysted in a number of amphibians and reptiles (Anderson, 1992). Because insects or earthworms are intermediate hosts for species in these genera, it is probably not surprising that larvae are found encysted in anoles. Whether anoles serve as paratenic hosts or accidental hosts only remains to be determined. New host records for these larvae in *Anolis aeneus*, *A. extremus*, *A. gingivinus*, *A. griseus*, *A. luciae*, *A. richardi*, *A. roquet*, *A. sabanus*, *A. trinitatus*, and *A. wattsi* are given in Table 2.

The other 6 nematodes are monoxenous with skin penetration, egg ingestion, or autoinfective routes of infection, and all have wide distribution patterns in the Caribbean. *Oswaldocruzia marechali* was recently described from *Anolis marmoratus* from Guadeloupe by Ben Slimane et al. (1995). It had previously been found in *A. oculatus* from Dominica (redetermination of specimen in Goldberg and Bursey, 1996).

Parapharyngodon cubensis has been reported from lizards, an amphisbaenid, and snakes (Coy Otero and Baruš, 1973, 1979; Bundy et al., 1987; Dobson et al., 1992; Goldberg et al., 1995). Its presence in *Anolis aeneus*, *A. extremus*, *A. griseus*, *A. luciae*, *A. marmoratus*, *A. richardi*, and *A. roquet* represents new host records (Table 2).

Spauligodon caymanensis was described recently from *Anolis conspersus* (Bursey and Goldberg, 1995) and has been reported from *A. oculatus* from Dominica (Bursey and Goldberg, 1996). Dobson et al. (1992) reported a nematode, *Skrjabinodon* sp. (possibly *anolis*), present in 6 species of anoles from the Lesser Antilles. This identification was done before *Spauligodon caymanensis* was described. Females of these 2 species are similar in appearance, with *S. caymanensis* the larger of the 2 species. Males are necessary for proper identification; species of *Skrjabinodon* lack caudal alae, whereas species of *Spauligodon* have caudal alae. We have examined 24 species of anoles and have never found representatives of *Skrjabinodon*. Prior to Dobson et al. (1992), the only reports of *Skrjabinodon anolis* were from Cuba and Puerto Rico (Baruš and Coy Otero, 1974; Acholonu, 1976;

Coy Otero and Baruš, 1979). We believe the specimens found by Dobson et al. (1992) to be *Spauligodon caymanensis* and have so listed them in Table 3; likewise, *Skrjabinodon anolis* is not listed as a nematode of anoles of the Lesser Antilles. *Anolis marmoratus* and *A. richardi* are new host records for *S. caymanensis*.

Trichospirura teixeirai has been found in the small intestine of several species of lizards from Cuba and the Dominican Republic (Baruš and Coy Otero, 1968; Powell et al., 1990). New host records are established for *Trichospirura teixeirai* in *Anolis extremus*, *A. gingivinus*, and *A. oculatus* (Table 2).

Two species of nematodes previously reported in Lesser Antillean anoles were not encountered in this study. Dobson et al. (1992) reported *Rhabdias* sp. from *Anolis wattsi* from St. Eustatius; Torres Ortiz (1980) reported *Rhabdias* sp. from *Anolis cristatellus*, *A. evermanni*, and *A. gundlachi* from several Caribbean locations. Species of *Rhabdias* are known from a large number of amphibians and reptiles (see Baker, 1987). The taxonomy of this group is complicated because adult parasites are all hermaphrodites and are difficult to separate to species. *Spinicauda spinicauda* was found previously in *Anolis oculatus* from Dominica (Goldberg and Bursey, 1996) and has been reported from *Ameiva ameiva*, *Anolis armouri*, and *Tupinambis teguixin* from Brazil and Trinidad (Pereira, 1935; Everard, 1975; Oliveira Rodrigues and Feijó, 1976).

Cystacanths of *Centrorhynchus* sp. have been reported from several species of anoles of the Caribbean (Bundy et al., 1987; Dobson et al., 1992; Goldberg et al., 1994). Adults of *Centrorhynchus* sp. are thought to be parasites of birds (Dobson et al., 1992). New host records for cystacanths are established for *Centrorhynchus* sp. in *Anolis aeneus*, *A. gingivinus*, and *A. richardi* (Table 2).

The occurrences of helminths in Lesser Antillean anoles from this study and others (Dobson et al., 1992; Goldberg and Bursey, 1996; Goldberg et al., 1996b) are summarized in Table 3. Clearly, *Parapharyngodon cubensis* has the widest distribution and has been found so far in all anoles examined except *Anolis trinitatis*. This helminth is monoxenous (direct life cycle) with infection likely due to contact with contaminated soil (Anderson, 1992). Its highest prevalence (75%) was in *Anolis sabanus*. *Spauligodon cay-*

manensis had the greatest mean intensity of infection (56.8), which occurred in *Anolis marmoratus*. *Anolis gingivinus* was infected with the greatest number of species (9); *A. trinitatis* harbored the fewest (1 species).

It is of interest to note that the islands with the largest numbers of helminth species (Anguilla, $N = 9$; Antigua, $N = 9$; and Dominica, $N = 9$) are located in the northern Lesser Antilles and are much closer to the larger islands (Cuba, Hispaniola), which have larger numbers of lizard host species than do the islands of the Lesser Antilles (Schwartz and Henderson, 1991). This closeness may have allowed greater interchange of parasites before the current isolation. Given the distribution patterns of the 6 monoxenous nematodes and their occurrence in a number of host species, perhaps it is more appropriate to speak of capture of host by parasite than the reverse. That anoles lack a unique helminths fauna suggests that ecological conditions favoring egg survival of monoxenous helminths and the distribution of intermediate hosts for heteroxenous helminths are much more important than the presence of a particular lizard host species. No doubt as more amphibians and reptiles from the Lesser Antilles are examined, they will be found to harbor many of the species of parasites listed in this paper. Indeed, there are 1 toad, 8 frog, 4 turtle, 42 lizard, and 21 snake species from the Lesser Antilles (Schwartz and Henderson, 1985) and, except for anoles, few have been examined for helminths.

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Appendix 1: Museum Accession Numbers of Specimens Examined

Abbreviations are as follows: Museum of Natural History, KU = University of Kansas; LACM = Natural History Museum of Los Angeles County; CM = Carnegie Museum of Natural History; and FMNH = Field Museum of Natural History.

- Anolis aeneus*, Grenada (KU): 250109, 250111, 250124, 250125, 250136, 250141, 250144, 250146, 250151, 250157, 250164, 250165, 250170–250172, 250174, 250176, 250182, 250183, 250185.
- Anolis extremus*, Barbados (LACM): 61767, 61768; (FMNH): 21097, 21099, 21100; St. Lucia (KU): 270589, 270591, 270595, 270602, 270605.
- Anolis gingivinus*, Anguilla (CM): 114654, 114657, 114662, 114681–114683, 114718, 114719, 114727, 114728, 114731, 114732, 114734, 114736, 114742, 114757, 114758, 115461, 115462, 115464, 115484, 115491, 115493, 115521, 115568, 117895, 117918, 117942, 117991, 117994, 117997, 117998, 118000, 118003, 118005, 118006, 119189, 119196, 119202–119204, 119207, 119210, 119211, 119213, 124406, 124407, 124410, 124413, 124414; (LACM): 114947–114952, 114965–114972; St. Barthélemy (LACM): 114953–114958; 114973–114980.
- Anolis griseus*, St. Vincent (KU): 257961, 257969–257971, 257973–257977, 257984.
- Anolis luciae*, St. Lucia (LACM): 61637, 61638, 61700–61711; (KU): 258494, 258495, 258497, 258500, 258502–258505, 258507–258509, 258511, 258514, 258517, 271076, 271079–271081, 271083, 271084.
- Anolis marmoratus*, Guadeloupe (KU): 258040–258061, 258206, 258213, 258214.
- Anolis oculatus*, Dominica (LACM): 61769–61771, 114915–114922.
- Anolis richardi*, Grenada (KU): 249949–249952, 249954–249961, 249963, 249965–249971.
- Anolis roquet*, Martinique (LACM): 114911–114914.
- Anolis sabanus*, Saba (LACM): 114931–114942.
- Anolis trinitatis*, St. Vincent (LACM): 61620–61636.
- Anolis watsii*, Antigua (KU): 246359, 246376, 246379, 246380, 246388, 246402, 246407–246409, 246412, 246416, 246417, 246419, 246421–246425, 246427, 246428.

Appendix 2: Helminths Deposited in the United States National Parasite Collection, USDA, Beltsville, Maryland

- Anolis aeneus*: *Parapharyngodon cubensis* 85475; *Physocephalus* sp. 85476; *Centrorhynchus* sp. 85477.

- Anolis extremus*: *Ascarops* sp. 86202, 86203; *Parapharyngodon cubensis* 86204; *Trichospirura teixeirai* 86205.
- Anolis gingivinus*: *Mesocoelium monas* 85478, *Oochoristica maccoyi* 85479, *Abbreviata* sp. 85480, 86206; *Ascarops* sp. 86207; *Parapharyngodon cubensis* 85481, 86209; *Physocephalus* sp. 85483, 86208; *Spauligodon caymanensis* 85482, 86210; *Trichospirura teixeirai* 86211; *Centrorhynchus* sp. 86212.
- Anolis griseus*: *Ascarops* sp. 86213; *Parapharyngodon cubensis* 86215; *Physaloptera* sp. 86214.
- Anolis luciae*: *Oochoristica maccoyi* 86344; *Parapharyngodon cubensis* 85484, 86216; *Porrocaecum* sp. 85485.
- Anolis marmoratus*: *Oswaldocruzia marechali* 85486; *Parapharyngodon cubensis* 85487; *Spauligodon caymanensis* 85488.
- Anolis oculatus*: *Mesocoelium monas* 86217; *Oswaldocruzia marechali* 86219; *Parapharyngodon cubensis* 86220; *Physaloptera* sp. 86218; *Spauligodon caymanensis* 86221; *Trichospirura teixeirai* 86222; *Centrorhynchus* sp. 86223.
- Anolis richardi*: *Parapharyngodon cubensis* 85489; *Physocephalus* sp. 85490; *Spauligodon caymanensis* 85491; *Centrorhynchus* sp. 85492.
- Anolis roquet*: *Parapharyngodon cubensis* 86225; *Physocephalus* sp. 86224.
- Anolis sabanus*: *Mesocoelium monas* 86226; *Abbreviata* sp. 86227; *Parapharyngodon cubensis* 86228.
- Anolis trinitatis*: *Physocephalus* sp. 85493.
- Anolis watti*: *Abbreviata* sp. 86229; *Parapharyngodon cubensis* 86230; *Spauligodon caymanensis* 86231; *Trichospirura teixeirai* 86232.